

**STRATEGY  
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**AN EVALUATION OF THE U.S. POLICY ON  
ANTI-PERSONNEL LANDMINES**

**BY**

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## **ABSTRACT**

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Landmines have received a great deal of attention. Debating their utility has become a major military/humanitarian issue. Current U.S. policy on anti-personnel landmines (APL) consists of three major positions. The first position is banning the use, stockpiling, production, and transfer of APL. The second position is to develop APL alternatives through aggressive research and development. The last position is to improve mine detection and clearing technology for current and future humanitarian demining operations. The purpose of this paper is to evaluate each major position against what has been done to date (looking at ends, ways, and means) and then extrapolate this out to the years 2020-2025. This paper evaluates the current policy's effectiveness by looking at the various programs implemented and actions taken to date. It concludes with recommended changes to U.S. Policy.



## TABLE OF CONTENTS

<b>ABSTRACT .....</b>	iii
<b>Illustration .....</b>	vii
<b>List of Tables .....</b>	ix
<b>AN EVALUATION OF THE U.S. POLICY ON ANTI-PERSONNEL LANDMINES ...</b>	1
EVOLUTION of U.S. POLICY ON ANTI-PERSONNEL LANDMINES .....	3
UNITED STATES LANDMINE INVENTORY .....	6
BANNING THE USE, STOCKPILING, PRODUCTION AND TRANSFER OF APL ..	10
DEVELOPING ALTERNATIVES TO APL .....	19
IMPROVING MINE DETECTION AND CLEARING TECHNOLOGY .....	23
PROJECTION TO 2025 .....	28
ENDS-WAYS-MEANS ANALYSIS .....	31
OPTIONS/COURSES OF ACTION .....	33
CONCLUSION .....	34
RECOMMENDATION .....	35
<b>ENDNOTES .....</b>	37
<b>BIBLIOGRAPHY .....</b>	41



**ILLUSTRATION**

FIGURE 1: CURRENT U.S. LANDMINES ..... 7



## **LIST OF TABLES**

TABLE 1: MINE CHARACTERISTICS .....	8
TABLE 2: ARMY MINE DELIVERY SYSTEMS WITH SELF-DESTRUCTING (SD) ANTI-PERSONNEL LANDMINES (APL) .....	9



## **AN EVALUATION OF THE U.S. POLICY ON ANTI-PERSONNEL LANDMINES**

In 1994, President Clinton was the first world leader that "called for the global elimination of land mines"<sup>1</sup> which maim and kill so many innocent people around the world each day. The President's initial goal, the global elimination of anti-personnel landmines, was refined to eliminate just the most dangerous types of anti-personnel landmines, or "dumb mines", since they are non-self-destructing (NSD). These non-self-destructing anti-personnel landmines (NSD APL) remain active and can cause casualties and death long after soldiers leave the area. "Smart mines", or self-destructing mines, are not viewed by the U.S. Government as "hidden killers", since they do not contribute to indiscriminate human carnage. They either self-detonate within days or become inactive when their batteries run out (usually within 90 days).

The United States, as a superpower, has the obligation to take the lead in the pursuit of "a comprehensive global ban on anti-personnel landmines (APLs) as soon as possible."<sup>2</sup> Current estimates place the total number of landmines in the ground somewhere between 60 to 100 million mines. In addition, expert assessments suggest that more mines are being removed than planted.<sup>3</sup>

It is estimated that APLs cause over 25,000 casualties each year.<sup>4</sup> This massive human destruction caused by APLs is a serious international humanitarian issue. Also, the presence of APLs prevents or hampers the political and economic reconstruction in areas of civil wars or other conflicts such as Bosnia and Mozambique. This makes landmines a political issue, a humanitarian issue and an economic issue in addition to an arms control issue.

These issues have raised the public awareness on the tremendous destructive capability of landmines. It has also raised a heated debate on the utility of landmines in military operations. Current U.S. policy on APL consists of three major positions. The first position is banning the use, stockpiling, production, and transfer of APL. The second position is to develop alternatives to APL through aggressive research and development. The last position is to improve mine detection and clearing technology for current and future humanitarian demining operations.

Achieving all these goals simultaneously in the current highly volatile, uncertain, complex, and ambiguous, (VUCA) environment will "stretch the fabric" of the U.S. Army's already highly resource constrained budget to the brink of tearing. The U.S. Government must very carefully balance the demands of the

national security strategy and the national military strategy along with its role in the globally interconnected environment.

It is impossible to be prepared for all possible contingencies to ensure the safety of our armed forces. Therefore, risk is accepted in various areas to allow good stewardship of meager resources.

The purpose of this paper is to evaluate each major action against what has been done to date (looking at ends, ways, and means) and then extrapolate this out to the years 2020-2025. The analysis will look at the risk the U.S. is assuming, the current policy's effectiveness, and finally recommend what the U.S. Policy should be on anti-personnel landmines.

### **EVOLUTION OF U.S. POLICY ON ANTI-PERSONNEL LANDMINES**

Current U.S. policy evolved somewhat from the President's first policy announcement on 16 May 1996. Three Presidential Decision Directives (PDD's) have been issued (PDD-48 dated 16 May 1996, PDD-54 dated 17 Jan 97, and PDD-64 dated 23 June 1998), negotiations have taken place, and Public Law 104-295 was passed. Now, a quick review of these four documents.

President Clinton's initial announcement, PDD-48, on 16 May 1996, concerning the United States policy on APL caused the Army to take two immediate actions. The first action was the unilateral decision to eliminate all use of NSD APL unless

specifically for countermine/demining training or for use in the DMZ in Korea. The second action was to cease all APL training to soldiers unless they were deploying to the Korean Theater.

On 17 January 1997, additional U.S. APL policy was announced (PDD-54) that directed two unilateral actions to strengthen the U.S. international position. First, the U.S. would place a cap on its stockpile of APL at current levels and would place a permanent ban on APL exports and transfers. Secondly, it stipulated that the United States would double its efforts to negotiate a global ban in the international venue of the Conference on Disarmament (CD).<sup>5</sup>

The current U. S. APL policy contained in the May 1997 "Report to the Secretary of Defense on the Status of DoD's Implementation of the U.S. Policy on Anti-Personnel Landmines" states:

"The United States is committed to ending the carnage and devastation caused by APL. [1] The comprehensive U.S. APL policy directs that the United States seek an international agreement to ban the use, stockpiling, production, and transfer of APL, with a view to completing the negotiations as soon as possible. [2] At the same time, the policy directs DoD to undertake an aggressive program of research, development, and procurement and to implement such other measures, as necessary, to permit the United States and its allies to end reliance on APL. [3] The U.S. policy further directs DoD to develop improved mine detection and clearing technology, share this technology with the broader international community, and expand significantly its humanitarian demining program to train and assist other countries in developing their own humanitarian demining programs."<sup>6</sup>

Several subsequent changes or exceptions to this policy have followed from failed attempts to modify an international agreement on landmines. Specifically, the United States joined the Ottawa Process, another international initiative to ban APL, with the intent to reach an agreement for a global ban on APLs. During negotiations on 17 September 1997, it became clear that the United States would have to withdraw from the process citing two areas of concern.

First, the unique situation in Korea necessitates the continued use of APL for security concerns. Second, the United States has a clear requirement for mixed systems (systems containing a mixture of anti-tank and anti-personnel landmine sub-munitions). Neither of these options are allowed under the Ottawa Treaty that calls for the complete ban of **all APL** usage, production, stockage, and transfer in addition to the requirement to destroy **all** mines in the ground.

To ease the concerns of the international committees, President Clinton issued PDD-64 on 23 June 1998, which implemented several unilateral U.S. actions. First, the U.S. will develop APL alternatives to end the use of **all APL** outside Korea by the end of 2003. Second, the U.S. will aggressively pursue an alternative to **all APL** for use in Korea by the end of 2006.<sup>7</sup> The use of self-destructing/self-deactivating APL, or

"smart mines" which the U.S. says does not contribute to the horrific carnage, will be continued until 2003.<sup>8</sup> Finally, the continued use of "mixed" systems, the combination of APL sub-munitions and anti-tank (AT) munitions, is authorized until APL alternatives are developed (i.e. 2006 or whenever the alternatives are developed).<sup>9</sup> The current goal is to sign the Ottawa Treaty by 2006, if all the aforementioned actions occur as projected.<sup>10</sup>

Several United States congressmen sponsored and passed Public Law 104-295 which requires an APL use moratorium for one year beginning on 12 February 1999, but authorizes use of APL in areas such as international borders and demilitarized zones, such as the DMZ in Korea.<sup>11</sup>

### **UNITED STATES LANDMINE INVENTORY**

The United States has both anti-personnel (AP) and anti-tank (AT) mines in its inventory (see Figure 1). Current mines consist of conventional mines, scatterable mines, and special purpose mines/munitions (see Table 1). The conventional mines consist of AT mines (M-15, M-19, and M-21) and AP mines (M-14, M-16, and M-18A1). AT mines were last procured in 1952 through 1962 and no procurement actions are pending.<sup>12</sup> Of the three

listed AP landmines, the M-18A1, CLAYMORE, does not fall into the category of a NSD APL since it is command detonated. The CLAYMORE mine meets the requirements for future use since a soldier must be in the firing chain to activate the mine.

Non Self-Destructing (NSD) or "Dumb" Mines	Self-Destructing (SD) "pure" Munitions	Self-Destructing (SD) "mixed" Munitions
M14 / M16 APL • Man-triggered • Korea only	Pursuit Deterrent Munition (PDM) (hand- emplaced ADAM) ----- Area Denial Artillery Munition (ADAM) (36 APL in each 155mm shell)	USN GATOR (45 AT, 15 AP) USAF GATOR (72 AT, 22 AP)  VOLCANO  5 ATL / 1 AP or 6 ATL (limited)
M15 / M19 / M21 ATL • Vehicle-triggered	Remote Anti-Armor Mine (RAAM) (9 ATL in each 155mm shell)	Modular Packed Mine System (MOPMS) (17 ATL / 4 AP)
Long-lived - Static fields / DMZs		- Short-lived (SD at 4 hr, 48 hr or 15 days) - Flexible and responsive: Placed ABOVE GROUND

**FIGURE 1: CURRENT U.S. LANDMINES**

From an information briefing by LTC Kevin Weddle to BG Stricklin on 28 May 1998, entitled: "Anti-Personnel Landmine Issues Update"

Within the U.S. Army's scatterable mines inventory, there are five mine delivery systems that have self-destructing anti-personnel landmines (SD APL) (See Table 2). They are the Volcano (1 AP and 5 AT in each round), Modular Packed Mine System (MOPMS) (4 AP and 17 AT), Area Denial Artillery Munitions (ADAM) (36 AP in each 155mm shell), Flipper (a manually fed dispenser system using M138 Ground Emplaced Mine Scattering System (GEMSS) mines), and the Pursuit Deterrent Munition (PDM), a hand emplaced ADAM.

MINES	PRESENT STATUS	ARMING	SAFE ARMING TIME	FUSING	SENSING WIDTH	ANTI-HANDLING DEVICE	SELF DESTRUCT
<b>CONVENTIONAL MINES</b>							
AT M-15	FIELDDED	MANUAL	N/A	PRESSURE	TRACK	YES	NO
M-19	FIELDDED	MANUAL	N/A	PRESSURE	TRACK	YES	NO
M-21	FIELDDED	MANUAL	N/A	TIILT ROD	VEHICLE	YES	NO
ICOMS	CONCEPTUAL	MANUAL	N/A	VARIOUS	VEHICLE	YES	NO
AP M-14	FIELDDED	MANUAL	N/A	PRESSURE	POINT	NO	NO
M16-A1	FIELDDED	MANUAL	N/A	PRESSURE	POINT	YES	NO
M18-A1 CLAYMORE	FIELDDED	MANUAL	N/A	COMMAND	N/A	NO	NO
<b>SCATTERABLE MINES</b>							
AT RAMM (M741/M114)	FIELDDED	1 G FORCE 2 SPIN	45 SEC 2 MIN	MAGNETIC	VEHICLE	20%	4 HR 48 HR
GEMMS (M-75)	FIELDDED	1 SPIN 2 ELECTRIC IMPULSE	45 MIN	MAGNETIC	VEHICLE	20%	5 DAY 15 DAY
GATOR (BLU-91/B)	FIELDDED	1 BORE PIN 2 ELECTRIC IMPULSE	2 MIN	MAGNETIC	VEHICLE	NO	4 HR 48 HR 15 DAY
MOPMS (M-78)	TYPE CLASSI-FIED	1 BORE PIN 2 ELECTRIC IMPULSE	2 MIN	MAGNETIC	VEHICLE	NO	4 HR UP TO 15 DAYS
VOLCANO (AIR/GROUND)	FIELDDED	1 BORE PIN 2 ELECTRIC IMPULSE	2 MIN	MAGNETIC	VEHICLE	NO	4 HR 48 HR 15 DAY
WAM	ENGINEER-ING DEVELOP-ENT	1 MANUAL 2 REMOTE	5-6 MIN 30-35 MIN	ACOUSTIC SEISMIC IR	600 FT	100%	4 HR 48 HR 5 DAY 15 DAY
AP ADAM (M731/M692)	FIELDDED	1 G FORCE 2 SPIN	45 SEC 2 MIN	TRIPWIRE	20 FT	100%	4 HR 48 HR
GEMMS (M-74)	FIELDDED	1 SPIN 2 ELECTRIC IMPULSE	45 MIN	TRIPWIRE	40 FT	100%	5 DAY 15 DAY
GATOR (BLU-92/B)	FIELDDED	1 BORE PIN 2 ELECTRIC IMPULSE	2 MIN	TRIPWIRE	40 FT	100%	4 HR 48 HR 15 DAY
MOPMS (M-77)	TYPE CLASSI-FIED	1 BORE PIN 2 ELECTRIC IMPULSE	2 MIN	TRIPWIRE	40 FT	100%	4 HR
VOLCANO (AIR/GROUND)	FIELDDED	1 BORE PIN 2 ELECTRIC IMPULSE	2 MIN	TRIPWIRE	40 FT	100%	4 HR 48 HR
<b>SPECIAL PURPOSE MINES/MUNITIONS</b>							
AT SLAM (SM 94)	ENGINEER-ING DEVELOP-ENT	MANUAL	2 MIN 1 MIN 1 MIN 2 MIN	MAGNETIC TIMED COMMAND PASSIVE IR	VEHICLE	100%	4 HR 10 HR 24 HR
AP PDM (M86)	FIELDDED	MANUAL	50 SEC	TRIPWIRE	20 FT	100%	4 HR

**TABLE 1: MINE CHARACTERISTICS FROM THE ENGINEER SYSTEMS HANDBOOK, PAGE 61.**

The U.S. scatterable mine inventory of AP mines does not meet the "man in the loop" requirement. If the U.S. were required to prematurely replace its entire inventory, to include

the significant stockpiles of AP and AT mixed systems, this would put a significant drain on the already constrained Department of Defense budget. With competing demands for a multitude of FORCE XXI and Army After Next (AAN) requirements it is impossible to be prepared for all possible contingencies to ensure the safety of U.S. Armed Forces.

Therefore, a systematic, deliberate, and well planned approach is required to ensure current munitions are replaced with systems meeting both the demands of the military community and the requirements of the various APL treaties being worked. If alternatives need to be developed quickly, spiral development programs or the Warfighter Rapid Acquisition Program (WRAP) may be the answer.

<b>SYSTEM*</b>	<b>BASIS OF FIELDING</b>	<b>APPROXIMATE QUANTITY OF MINES</b>
<b>VOLCANO</b> (Employed via Helicopter or via ground vehicles)	2 SYS/ENGR COMPANY 3 SYS/SELECTED ASSLT HELO CO (ONE CO PER DIV/CORPS/ACR)	135,800 CANISTERS OF 1 AP, 5 AT EACH
<b>MOPMS</b> (Modular Packed Mine System)	CLASS V ITEM	2,300 SYSTEMS OF 4 AP, 17 AT EACH
<b>ADAM</b> (Area Denial Artillery Munitions)	BASIC LOAD, ALL 155mm BNS	167,400 ROUNDS OF 36 AP PER ROUND
<b>FLIPPER</b>	HELD IN WAR RESERVE	76,000 MINES
<b>PURSUIT DETERRENT MUNITION (PDM)</b>	CLASS V ITEM	16,154 MINES

\*Note: The GATOR aircraft-delivered system via Navy and Air Force platforms supports Army operations. There are approximately 14,100 systems that dispense a mix of AP and AT mines. The Air Force has approx 10,800 systems of 22 AP and 72 AT per system. The Navy has approximately 3,300 systems of 15 AP and 45 AT per system.

**TABLE 2: ARMY MINE DELIVERY SYSTEMS WITH SELF-DESTRUCTING (SD) ANTI-PERSONNEL LANDMINES (APL)<sup>13</sup> FROM AN INFORMATION PAPER ON APL ISSUES DATED 28 SEPTEMBER 1998 FOR CG, USAREUR**

## **BANNING THE USE, STOCKPILING, PRODUCTION AND TRANSFER OF APL**

To properly discuss the U.S. efforts to ban the use, stockpiling, production and transfer of APL it is necessary to discuss the ongoing actions within the international community to pursue a global APL ban. Currently, the United States is involved in three different international instruments to address APLs.

The first international instrument is the Ottawa Treaty, formerly titled the "Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction", which "the United States will sign...by 2006 if...[it] succeed[s] in identifying and fielding suitable alternatives to...[its] self-destructing APLs and mixed anti-tank systems by then."<sup>14</sup> The Ottawa Treaty stipulates that a full ban on antipersonnel land mines goes into effect 10 years after 40 nations ratify it.<sup>15</sup>

On 17 September 1998, Burkina Faso became the 40th nation to ratify the Ottawa Treaty. The treaty becomes binding international law on 1 March 1999, which is the first day of the sixth month after the 40<sup>th</sup> nation signed the treaty.<sup>16</sup> Until the United States signs the treaty other countries may request similar exceptions that the U.S. requested before it withdrew from the Ottawa Treaty negotiations.

"Among the forty [nations]<sup>17</sup> ratifying [the Ottawa Treaty] thus far are not only nations that led the Mine Ban [Ottawa] Treaty negotiations (such as Austria, Canada, Ireland, Norway and South Africa), but also nations that [were] major producers and exporters of landmines (such as France, Germany, United Kingdom, and Hungary) and nations where mines have been used most extensively (such as Bosnia, Croatia, Mozambique and Zimbabwe.)"<sup>18</sup>

There are also 130 signatories of the treaty which have not committed to ratification. The list of countries includes "[a]ll of the Western Hemisphere except the U.S. and Cuba, all of NATO except the U.S. and Turkey, all of the European Union except Finland, 42 African Countries, and 17 [countries] in the Asia-Pacific region, including Japan."<sup>19</sup> Noticeably absent from the countries backing this treaty besides the United States are "Russia, China, India, Pakistan, Greece, Turkey, South Korea, North Korea, and most of the countries of the Middle East."<sup>20</sup> However, China, Russia, India and Pakistan are participants in the Convention on Conventional Weapons (CCW).<sup>21</sup>

The second international instrument is the Convention on Conventional Weapons.

"[I]n 1997 the Administration submitted for Senate advice and consent the Amended Landmine Protocol to the Convention on Conventional Weapons, which bans the unmarked, long duration APLs that caused the worldwide humanitarian problem."<sup>22</sup>

Through the last international instrument, the United States has "established a permanent ban on APL exports and [is] seeking to

universalize an export ban through the Conference on Disarmament in Geneva.”<sup>23</sup>

The third international instrument is the Conference on Disarmament. The U.S. administration has decided “that the Geneva-based UN Conference on Disarmament (CD) is the appropriate forum for negotiating a global ban [of APL].”<sup>24</sup> Russia considers the CD “the most suitable forum” for discussing the issue of landmines.<sup>25</sup>

“In the CD’s favor, its membership is far more relevant to the landmine crisis; it includes all the major producers of mines (the United States, Russia, China, India and Pakistan); those states that have recently renounced production (France, Britain and South Africa); and those countries that have led the campaign for a global ban (Canada and Sweden). Unfortunately, few of the mostly heavily mine-infested countries belong to the CD.”<sup>26</sup>

At the heart of the controversy is the “smart mine” exception, which most other countries participating in the international negotiations oppose. Regardless of the publicity and the public support for a global landmine ban, the U.S. continued to demand an exception to use smart mines in addition to APL in Korea due to military requirements and the protection of U.S. national security interests.

The 1998 National Security Strategy (NSS) states there are five threats to U.S. interests including regional or state-centered threats (read Iran/Iraq and North Korea), transnational threats, spread of dangerous technologies, foreign intelligence

collection and failed states. Within the first category the NSS states that Southwest Asia and East Asia are specifically cited for their concern and further comment that

"[f]or the foreseeable future, the United States, preferably in concert with allies, must remain able to deter and defeat large-scale cross-border aggression in two distant theaters in overlapping time frames."<sup>27</sup>

The Korean major theater of war (MTW) scenario is what the U.S. says necessitates it to keep APLs in its inventory.

The Report of the Quadrennial Defense Review (May 1997) states the U.S. national interests are at risk on the Korean peninsula suggesting that the two MTW planning scenario is correct. However, the December 1997 report of the National Defense Panel states that the U.S. can take the risk in Korea and that there could be a reconciled Korean peninsula, if not unified, by the year 2020. This gives the indication that planning for a two MTW contingency is a poor utilization of Department of Defense resources.

The question is whether landmines will thwart or even reduce the possibility of a North Korean invasion of South Korea. One possible answer is that it has worked since 1953 with the signing of the armistice. Or has it? Has it been the presence of an U.S. Army division or a robust Republic of Korean military presence on the Korean peninsula? Regardless of the answer, what remains is the very real threat that North Korea

could invade South Korea in a short-notice or no-notice scenario.

Even though North Korea possesses biological and other weapons of mass destruction (WMD) in its weapons arsenal, it has not attacked South Korea even during periods of increased instability in 1996 and 1997. This does not negate South Korea as a bona-fide MTW. However, does the APL presence in the DMZ in Korea provide a significant military advantage?

The International Committee of the Red Cross (ICRC) conducted a study entitled "Military Use and Effectiveness of Anti-personnel Landmines." This study looked at conflicts over the past 55 years to determine the effectiveness of APL in various applications. This report concluded that "[t]he material which is available on the use of AP landmines does not substantiate claims that AP mines are indispensable weapons of high military value."<sup>28</sup>

In addition to the Red Cross, numerous retired general officers supported the ban of APL in an open letter to President Clinton published in the New York Times on April 3, 1996 and through various other media. Officers signing the open letter included GEN David C. Jones, former chairman of the Joint Chiefs of Staff along with 14 other retired senior military officers including General H. Norman Schwarzkopf<sup>29</sup> and LTG James F. Hollingsworth<sup>30</sup>, former Commander of I Corps in Korea.<sup>31</sup> LTG

Hollingsworth thinks by requesting an exception for Korea the United States opens the door for other countries to make their own exceptions. He also believes the United States can use electronic surveillance equipment in lieu of mines in Korea.

GEN Alfred Gray, former U.S. Marine Corps Commandant stated:

"I know of no situation in the Korean War, nor in the five years I served in Southeast Asia, nor in Panama, nor in Desert Shield-Desert Storm where our use of mine warfare truly channelized the enemy and brought him into a destructive pattern. I'm not aware of any operational advantage from [the] broad deployment of mines."<sup>32</sup>

On the other side of the issue, opposing the ban was a strong concern of active duty generals who wrote a letter dated 10 July 1997, to the Senate Armed Services Committee Chairman Strom Thurmond. Gen. John M. Shalikashvili, then Chairman of the Joint Chiefs of Staff, the Joint Chiefs, and the 10 regional and functional commanders in chiefs (CINCs) signed this letter. Their letter stated that landmines are a combat multiplier for land forces,

"...especially since the dramatic reduction of the force structure. Self-destructing land mines greatly enhance the ability to shape the battlefield, protect unit flanks and maximize the effects of other weapons systems. Self-destructing land mines are particularly important to the protection of early entry and light forces, which must be prepared to fight outnumbered during the initial stages of a deployment."<sup>33</sup>

It appears from this discussion that the viewpoint taken on whether or not to support the ban depends upon if the general is on active duty or not. A large number of retired generals support the ban while the generals on active duty who have gone on the record feel that anti-personnel landmines are a military requirement. One reason for this could be that those on active duty do not want personnel under their command to be put in harms way.

If APLs are a "combat multiplier" and save lives, then APL will stay in the inventory. When APLs are no longer a "combat multiplier" they will be deleted from the inventory. Senior leaders on active duty do not want to be associated with the idea that they removed a viable weapon from the hands of their subordinates which may result in more casualties, especially on the Korean peninsula should the North Koreans attack.

LTG (RET) Gard, who signed the letter supporting the ban, stated that "[c]areer military members are taught from the beginning of their careers to resist any effort to remove a weapon from their arsenal that could save the lives of their troops."<sup>34</sup> Continuing in this vein, he did not expect the current Joint Chiefs of Staff to willingly give up the right to use APL any more than President Wilson's War Department was willing to give up the ability to employ poison gas after World War II. However, as LTG Gard stated, President Wilson "understood the

treaty's obligation to balance the military utility of a weapon against the cost of its use."<sup>35</sup> President Wilson signed the poison gas ban.

General Jones in his open letter stated that the permanent and total international ban on the production, stockpiling, sale and use of APL was "not only humane but also militarily responsible."<sup>36</sup> The letter went on to say that "[t]he rationale for opposing anti-personnel land mines is that they are in a category similar to poison gas; they are hard to control and often have unintended harmful consequences (sometimes even for those who employ them)."<sup>37</sup> He went on to say that our currently available vast arrays of weapon systems make APL non-essential and eliminating APL from the military weapons inventory would not "undermine the military effectiveness or safety of our forces, nor those of other nations."<sup>38</sup>

This lengthy discussion on the use of APL can go on indefinitely. Each side can provide simulations/explanations that state their position: that APIs are necessary for combat and give the commander various options to shape the battlefield and channalize the enemy or that they provide minimal if not greater hindrance to combat operations and should be eliminated from the battlefield altogether. Regardless, on 16 May 1996, the President initiated the unilateral direction to cease using NSD APIs, except for countermine/demining training and the

defense of Korea. The U.S. retained the right to use self-destructing APIs since the belief is that these do not contribute to the humanitarian problem.

The next areas to be addressed are the stockpiling, production, and transfer of APIs. On 30 June 1998, the Army detonated 80 non-self-destructing landmines at the Crane Army Ammunition Activity (AAA), Indiana. This event commemorated the final destruction of the U.S. stockpile of over 3.3 million non-self-destructing anti-personnel landmines (M-14's and M-16's) eighteen months ahead of schedule.<sup>39</sup> The initial goal set by the President required the destruction of all NSD APIs, except those needed in the defense of the Republic of Korea and for training purposes, by 31 December 1999.

There are still about one million NSD-APL still in existence, most of which are stockpiled on the Korean peninsula. There are small numbers retained at various training locations to assist in the requirement of demining training. Currently the U.S. maintains API stockpiles in Germany, Norway, Spain, Italy, and Greece and on pre-positioned ships based at Diego Garcia, a United Kingdom territory.<sup>40</sup>

The final two areas are production and transfer. The production of NSD APIs has ceased and, as previously discussed, the NSD APIs have also been eliminated, with stated exceptions. As the U.S. searches for API alternatives it retains the option

to use SD-APL mixed systems to defend U.S. interests. On 17 January 1997, the U.S. announced two more unilateral actions. They were to impose an APL stockpile cap at current inventory levels and a ban on APL export and transfers.<sup>41</sup>

### **DEVELOPING ALTERNATIVES TO APL**

The first question is why do we need alternatives to APLs? To answer this question one must look no further than a current newspaper article entitled, "Flooding From Mitch Displaces Landmines."<sup>42</sup> The flooding caused by Hurricane Mitch scattered mines across fields and villages in Santa Catarina, Honduras. One unfortunate farmer came across an AT mine while planting watermelons in a field. He had become familiar with AP mines with mental sprouts out the top. This AT mine looked like a wheel rim and after he poked at it with the point of his machete the blast threw him 80 feet into the air. Others standing in the area were killed or badly injured. Now the villagers are afraid to go into the fields or travel in fear of becoming a victim.

This poignant example illustrates the horrific problems landmines pose to the innocent victims that activate landmines of all types long after the soldiers leave the area. If landmines self-destructed or were somehow rendered inactive

shortly after soldiers left an area this carnage would end. Or, if landmines were eliminated altogether this carnage would end.

The one obvious alternative to landmines is to totally eliminate their use; thus the global landmine ban. To remove the mines in the Korean scenario requires a significant increase in the forces in that theater to provide the required stopping power equal to the mined DMZ. One estimate of this force equates to "17,000 additional troops, 350 additional tanks, 410 additional Bradley Fighting Vehicles, 24 additional helicopters, and 144 other aircraft."<sup>43</sup> This is a substantial cost and the forces would need to be in theater or be deployed immediately to counter the expected "no-notice" or "short notice" attack by the North Korean forces. In lieu of this force an antipersonnel landmine alternative (APL-A) that would possibly perform the same function as the in-place mines might be the answer.

To develop an APL-A one must know the definition of an APL. The Ottawa Treaty defines an antipersonnel landmine as:

"a mine designed to be exploded by the presence, proximity or contact of a person and that will incapacitate, injure or kill one or more persons. Mines designed to be detonated by the presence, proximity or contact of a vehicle as opposed to a person, that are equipped with anti-handling devices, are not considered anti-personnel mines as a result of being so equipped."<sup>44</sup>

This definition encompasses all the U.S. mines with the exception of the CLAYMORE mine, which is command detonated (has

a soldier-in-the-loop to activate the munition). Therefore, APL-A must be command detonated for the definition not to apply to them.

The Secretary of Defense has directed the Department of Defense to aggressively pursue a program to develop APL-As to meet the Presidents guidelines for use of APL outside of Korea by 2003 and inside Korea by 2006. To accomplish this enormous task an aggressive research and development program will look at a replacement for mixed systems and develop and acquire APL alternatives that meet operational requirements. The three program objectives are:

1. Redesign, repackage and retrofit the Remote Anti-Armor Mine (RAAM) into a mixed system, fully compliant with the Presidents decision.
2. Develop and implement an alternative to the Pursuit Deterrent Munition (PDM).
3. Develop and implement alternatives to meet the requirement currently met by APL (both non-self-destructing and self-destructing), particularly for Korea.<sup>45</sup>

The Under Secretary of Defense for Acquisition and Technology (USD(A&T)) is the responsible agency for the oversight of a two-track effort on APL alternatives. The first track is an Army lead that focuses on the near term and has two parts. The first part is the Remote Area Denial Artillery Munition (RADAM) program to combine the ADAM and RAAM into a mixed system by FY 03. (Funding delays have caused this program timeline to slip.) The second part is an APL alternative for

the NSD APL requirements for Korea by FY 06. Funding of \$573 million has been provided for this program through FY 03 with out-year funding identified. Pursuit of an alternative to PDM was halted. Defense Advanced Research Projects Agency (DARPA) has the lead on the second track that is a longer-term DOD effort looking out to 2010 and beyond. This track will develop innovative concepts for barrier systems that may replace APLs or eliminate the need for mines altogether.<sup>46</sup>

The range of humanitarian APL-As runs the gambit from lethal to non-lethal. It could be something as simple as a laser that temporarily blinds soldiers or something very technological. At the 1998 Army of the United States of America (AUSA) Conference one presentation showed a future concept of "critters and spikers". Basically, what the future holds could be some small charges, each about the size of a big bumble bee, that fly in mass to a target, land on it in mass and then explode. Recently, forty companies submitted a total of 52 "White Paper" proposals from which three were selected for contract award (two lethal options and one combination of a lethal and non-lethal "kill" mechanism).<sup>47</sup>

Currently a non-self destruct alternative currently under development is very similar to the Raptor Intelligent Combat Outpost that is also under development. The Raptor employs Hand Emplaced-Wide Area Munitions (HE-WAMs). The Raptor system

categorizes enemy vehicles, reports this information through a gateway/repeater to a control station, and then once given the command to destroy the target it engages targets up to 100 meters away.

The NSD APL-A under development uses a similar soldier-in-the-loop command procedure using hand-emplaced munitions/detectors sending messages to a control station, which in turn can activate the munitions to engage a target. The munition can be either lethal, non-lethal or a combination. All components are retrievable to be relocated or reused at a later time thereby reducing the need for minefield clearing.

#### **IMPROVING MINE DETECTION AND CLEARING TECHNOLOGY**

Once alternatives to APL are developed and fielded there remains the significant problem of the existing landmines already in the ground. Efficiently eliminating existing in-place landmines requires extensive research and development effort in the field of mine detection and clearance technology. Once this new technology is developed the United States must share it with the international community. In addition, to rid the world of these hidden killers, the United States must significantly expand its humanitarian demining program to allow other countries to develop their own indigenous humanitarian demining programs.

The U.S. initiative to accomplish these goals is the global humanitarian demining initiative entitled "Demining 2010", which was announced on 31 October 1997. The goal of this program is to eliminate all landmine casualties by 2010. President Clinton appointed Assistant Secretary Karl F. "Rick" Inderfurth as the Special Coordinator to head this program. He acts as the spokesperson and implements both policy guidance and a National Security Council (NSC) approved U.S. Government strategy with achievable milestones and suitable measures of effectiveness.

The key to making this program work is the development of highly efficient minefield detection and clearing technologies. With improved detection and clearance measures the task of ridding the world of these "hidden killers" will be much easier, even though mines today can be produced with very little metal materials. As we progress further into the "information age" the goal is to take advantage of the technological advancements to make this "Demining 2010" initiative a reality.

The demining process can be broken down into three basic stages: detection, removal, and disposal/neutralization.<sup>48</sup> Detecting landmines is the most difficult part of the humanitarian demining process so this is where most of the research and development effort is placed. Removal and disposal is relatively easy once the mine is located.

Both civilian and military agencies are interested in the best mine detection solution possible and both are working to develop an efficient and cost effective solution that does not have a high false alarm rate. That is to say that the detection method actually finds the mines without alerting the operator to tree roots, rocks or other items that may "look" like a mine but are not mines. Most mine detection strategies are based on either detecting the change in soil properties, which occurs when the mine is buried, or the fact that the mine has different physical properties, such as density or thermal capacities, compared to the surrounding soil.

There are numerous detection methods under development. They range from the high-tech methods to brute force to explosive devices. The high-tech methods include infrared, advanced electromagnetic induction (EMI), acoustic sensors, nuclear radiation, chemical detection, bacteriological, microwave, and ground penetrating radar. The brute force methods consist of ploughs, rakes, rollers, or flails mounted on heavy vehicles (some with robotics). The last method, explosive breaching, consist of devices such as the minefield clearing line charge (MICLIC) and the explosive standoff breaching charge.

Even with all this high technology working on the problem, the most reliable detection method is not high-tech, it is hand

probing. This method employs a 25 centimeter-long non-metallic probe that is manually inserted in the ground every five centimeters or so at about a 30° angle to detect a solid object. This is by far the most time consuming method, not to mention very hazardous and expensive.<sup>49</sup>

Some of the high-tech military methods under development include the Airborne Standoff Minefield Detection System (ASTAMIDS), the Ground Standoff Minefield Detection System (GSTAMIDS), and the Handheld Standoff Mine Detection System (HSTAMIDS). These systems will detect both metallic and non-metallic mines by taking advantage of advances in ground penetrating radar. These systems are at least three years from being fully developed, and longer to get the devices fielded.

Another high technological development, one that the Defense Advanced Research Projects Agency (DARPA) is developing, is a device that will mimic a dog's keen sense of smell. Most of the detection devices mentioned don't look for characteristics unique to mines. They look for changes in density, changes in soil properties, and the like. This device that mimics a dog's nose will focus on the scent of explosives within the mine.<sup>50</sup> The possible outcome of this research when coupled with highly accurate surveys, possibly from the STAMIDS systems, could possibly "make the concept of land mines in war obsolete."<sup>51</sup>

Regardless of the detection method used, once the mine is detected it has to either be destroyed in place or neutralized and destroyed later. Some of the detection methods mentioned earlier are also clearance devices such as the ploughs, rakes, rollers, and flails. Mines that do not detonate from these invasive detection methods must then be neutralized.

Some developments in this area consist of explosive foam, mine marking and neutralization foam, shaped charges, and chemical neutralization.<sup>52</sup> Once the mine is neutralized it can be safely removed for further demilitarization procedures.

At this time there does not seem to be one method that is a panacea for all the various types of mines or the various mediums that mines can be placed in. As each new method shows promise it must be considered in its own right and employed appropriately. However, as various breakthroughs are found the technology must be exported to other nations to assist in the global demining effort.

The Department of Defense has focused its efforts on demining training via the "train-the-trainer" concept for the countries that receive humanitarian demining assistance. Once the in-country teams are trained they are the ones that actually remove the mines.

## **PROJECTION TO 2025**

It is next to impossible to predict with any reliability what the world will be like in the year 2025. However, it is possible to develop various possible models based on various likely options. However, without knowing **the** threat(s) or **the** type of war to be fought, it is next to impossible to know the impact that landmines will have in future wars. One thing is for sure, the world is changing and so is the way we should think of the future.

In HOPE IS NOT A METHOD Gordon R. Sullivan talks about not worrying about predicting the future with pinpoint accuracy. Instead, just get it "good enough to seize and exploit developing opportunities, good enough to deploy your forces more rapidly than your competitors, [or] good enough to get it "about right" in execution."<sup>53</sup> These are simple and profound words that take enormous talent to execute.

Even if the U.S. "sees" a world void of countries using landmines and itself abandons using them, what is to prevent irrational actors from employing them on their own without the permission of the country's leadership? With that in mind the U.S. must retain a countermine capability, both detection and clearance, to overcome these obstacles. The challenge becomes developing alternatives to landmines that provide at least the equivalent military effectiveness of today's landmines that are

safe and cost effective to use that conform to the accepted definition of what constitutes an APL.

Are mines even necessary? What will wars in the future look like? Will they be as large or larger than Desert Storm, or will they be something on a much smaller scale? How will doctrine change? What will be the role of weapons of mass destruction (WMD)? Suffice it to say that some type of mine/munition device may be used in the future even if it is a "smart mine" or "smart munition" that can actually determine an enemy target and decide to either incapacitate it, destroy it, or not to attack at all. Whether it is a high-tech "spiker" or some other futuristic device, the U.S. needs to be prepared to combat some type of mine/munition in the future.

Much must be done to get to the future. The United States caused concern within domestic and international communities by stipulating exceptions to the global ban on APL's. The current plan allows the U.S. to be APL independent by 2006; however the 2<sup>nd</sup> and 3<sup>rd</sup> order effects of the U.S. delaying the elimination of APL are not known. For example, what effect will this have on the ratified Ottawa Treaty? If the U.S. does not sign the Ottawa Treaty what effect will this have on the future landmine ban?

Should the United States not sign the Ottawa Treaty it may lose some moral leadership in the eyes of a few countries and

would definitely forfeit negotiating leverage. Regardless, the United States must take all unilateral efforts to enforce as much of the treaty as possible.

All U.S. unilateral actions do very little to mitigate the continuing growing humanitarian problem. So why should the U.S. retain the use of some APLs? The focus is on national security, risk (either perceived or real), and on protecting the lives of U.S. service members. Accepting a greater degree of risk, however, could allow the ban to take effect immediately with the U.S. as a full participant. International and domestic political pressure placed on the U.S. may, in any event, drive changes in current policies.

Looking at the Korean situation, there are basically four options that could occur. For one, the situation could continue as it has since 1953 without any significant change. Secondly, the Koreas could peacefully unite such as the former East Germany did with the Federal Republic of Germany. The last two options spell trouble for the Korean peninsula in the short term because one of the following violet options could materialize: either North Korea implodes or it explodes.

The U.S. uses the argument that the mined DMZ provides protection for the troops in South Korea. The basis of this argument is that North Korea will attack on short notice or no-notice. Should the mined DMZ be removed, it is estimated that

significant numbers of timely reinforcements are needed to repel the invasion. On the other hand, even if mines are present, what is to stop the North Koreans from just pushing through the minefield sacrificing the few it takes to breach the minefield?

With the possible leap-ahead technological advancements in the short term in the area of standoff mine detection systems and surveys, mines may soon lose the military advantage they provide today. Doctrine is already being rewritten and research in the area of alternatives is moving ahead. It will be some time, after 2025, before we see the "spikers", shown in concept at the Annual AUSA Conference, taking the role of today's landmines.

#### **ENDS-WAYS-MEANS ANALYSIS**

The U.S. policy clearly articulates the objective of a global ban on the use of APL, even though the initial goal was a global ban on all landmines (anti-tank and anti-personnel). The United States has participated in numerous international negotiations on a global landmine ban to reach its objective, but has insisted on several exceptions. The main exception, that of retaining the use of "smart mines" and banning only "dumb mines", goes against the broader popular goal of a global ban on **all** APL. This dilemma "is probably the most important problem [in this area] for the United States."<sup>54</sup>

After looking at the stated objectives (ends) and discussing at length the stated actions (ways), one must examine the means. The resources, or means, to support the APL ban are meager in relation to what must be done. The real quandary is how to apportion the limited Army resources between an arms control/humanitarian/political/economic issue, fighting systems, and the multitude of other requirements facing the Department of Defense. Current plans allocate a total of \$573 million out to FY03 to support the APL alternatives for the NSD APL.<sup>55</sup> The U.S. began in earnest supporting humanitarian demining operations in 1993 and has spent \$236 million to date towards that effort.<sup>56</sup> It should be noted that U.S. soldiers do not perform actual demining operations but provide training to various organizations on the train-the-trainer concept on how to remove mines.

This ends-ways-means analysis reveals that the U.S. policy is somewhat contradictory. A ban on APL is the goal (end), yet certain prudent military courses of actions (ways) identify exceptions for certain types of APL. This compromise reflects the competing demands on the U.S. policy. Allocated resources seem adequate to provide APL alternatives and to meet demining requirements within the proposed timetable and available resources. Are the exceptions really stopping the U.S. from signing the Ottawa Treaty?

## **OPTIONS/COURSES OF ACTION**

The problem of ridding the world of landmines could be somewhat equated to the "war on drugs", to combating terrorism, or to eliminating weapons of mass destruction. Do we attack the supply side or the demand side? Production costs of landmines range from \$3 to \$30, but it costs at least \$300 to detect and remove an underground mine.<sup>57</sup> Since landmines are inexpensive and relatively easy to make, it will be difficult to prevent their distribution. On the demining side, the sheer number of emplaced mines makes their removal extremely costly.

Purely from the national security and cost perspective, it is easy to see that the global ban on landmines will require the total commitment of political, diplomatic, economic, and military resources. The U.S. must employ diplomacy to get most of the mine-using and mine-producing countries and their governments to rally behind the ban and develop methods of verification, detection, and punishment for failing to comply with established international regulations.

At this juncture, the U.S. can pursue three courses of action. First, it can continue on its current course. This will not solve any of the aforementioned problems. The second option is to arrive at some type of compromise. The U.S. tried this during the Ottawa process when it requested that Korea be exempt until 2006. The international community rejected this

idea and held fast to an immediate global ban. The third option is to immediately agree to the ban without exceptions, thereby requiring alternatives to be developed in a shorter period of time. This would allow the U.S. as the world superpower to take the lead in the global ban of APL's.

## CONCLUSION

The United States caused concern within domestic and international communities by stipulating exceptions to the global ban on APL's and not signing the Ottawa Treaty.

Article 5 of the Ottawa Treaty stipulates that countries have 10 years from the date of ratification to destroy all APLs within mined areas under their "jurisdiction or control" with provisions for extensions. Mined areas must be properly marked and fenced to prevent civilians from becoming harmed. By not signing this treaty the United States may lose some moral leadership in the eyes of a few countries. Regardless, the United States must take all unilateral efforts to enforce as much of the treaty as possible.

All U.S. unilateral actions do very little to mitigate the growing humanitarian problem. As long as mines are in place there will be pain, suffering, and death by unfortunate individuals unwittingly discovering the "hidden killers".

So why retain the use of some APLs? The focus is on national security, risk (either perceived or real), and on protecting the lives of U.S. service members. Accepting a greater degree of risk could allow the ban to take effect immediately. However, the international political pressure placed on the U.S. may drive changes in current policies.

### **RECOMMENDATION**

The United States should immediately sign the Ottawa Treaty. It should continue on its current course and aggressively pursue an APL alternative by accelerating research and development to allow early deployment of suitable APL alternatives within the next few years. The U.S. must complement their efforts by pressing for agreements in both the Conference on Disarmament and the Convention on Conventional Weapons.

By eliminating the need for APLs by 2006, the U.S. can ensure that APLs should be only a demining issue. By accepting these risks, the "smart mine" exception can also be withdrawn. Then the U.S. will emerge truly as the leader of the global APL ban.

The U.S. Government should take these actions now. Signing the Ottawa Treaty (which provides the United States 10 years to develop alternatives and remove the mines in Korea) and making

significant strides in other international negotiations will put both the U.S. and the world in better shape in the 2010 to 2025 timeframe. By this time our policy would just be enforcement of the agreements, continued work on APL alternatives to improve on those already fielded, and continuing support for national and international demining activities.

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## ENDNOTES

<sup>1</sup> White House Press Release, "Remarks by the President on Land Mines," September 17, 1997, available from <http://www.pub.whitehouse.gov>; Internet; accessed 2 October 1998.

<sup>2</sup> The White House, A National Security Strategy for a New Century, The White House, May 1997, 7.

<sup>3</sup> U.S. Department of State, Bureau of Political-Military Affairs, Office of Humanitarian Demining Programs, Hidden Killers: The Global Landmine Crisis, Washington, D.C., September 1998, Executive Summary.

<sup>4</sup> White House Press Release, "U.S. Efforts to Address the Problem of Anti-Personnel Landmines," May 16, 1996, available from <http://www.pub.whitehouse.gov>; Internet; accessed 17 September 1998.

<sup>5</sup> White House Press Release "Report to the Secretary of Defense on the Status of DoD's Implementation of the U.S. Policy on Anti-Personnel Landmines," May 1997, available from <http://www.defenselink.mil/pubs/landmines/>; Internet, accessed 17 September 1998.

<sup>6</sup> Ibid.

<sup>7</sup> The White House, A National Security Strategy for a New Century, The White House, October 1998, 11.

<sup>8</sup> Ibid.

<sup>9</sup> John Spinelli, LTC <spinejj@hqda.army.mil>, Information Paper for CG, USAREUR entitled: "Anti-Personnel Landmine (APL) Issues," electronic mail message to LTC Dale A. Carr, 25 September 1998.

<sup>10</sup> A National Security Strategy for a New Century, October 1998, 11.

<sup>11</sup> Spinelli, 3.

<sup>12</sup> U.S. Army Engineer School, Engineer Systems Handbook, Fort Leonard Wood, Missouri, April 97, 54.

<sup>13</sup> Spinelli, 3.

<sup>14</sup> A National Security Strategy for a New Century, October 1998, 11.

<sup>15</sup> Nick Adde, "Former Brass Support Ban," Army Times, 15 June 1998, p. 12.

<sup>16</sup> International Committee to Ban Landmines, "Landmine Treaty Ratified by Forty Countries in Record Time," 17 September 1998; available from <http://www.icbl.org/release/sept17.html>; Internet; accessed 8 November 1998.

<sup>17</sup> The forty nations to ratify the treaty are: Andorra, Austria, Bahamas, Belgium, Belize, Bolivia, Bosnia-Herzegovina, Bulgaria, Burkina Faso, Canada, Croatia, Denmark, Djibouti, Equatorial Guinea, Fiji, France, Germany, Grenada, Holy See, Hungary, Ireland, Jamaica, Macedonia, Mauritius, Malawi, Mali, Mexico, Mozambique, Niue, Norway, Peru, Samoa, San Marino, South Africa, Switzerland, Trinidad and Tobago, Turkmenistan, United Kingdom, Yemen and Zimbabwe.

<sup>18</sup> International Committee to Ban Landmines, "Landmine Treaty Ratified by Forty Countries in Record Time," 17 September 1998; available from <http://www.icbl.org/release/sept17.html>; Internet; accessed 8 November 1998.

<sup>19</sup> Ibid.

<sup>20</sup> Jim Wurst, "Closing in on a Landmine Ban: The Ottawa Process and U.S. Interests," Arms Control Today, June/July 1997, 14.

<sup>21</sup> Michael J. Matheson, "New Landmine Protocol is Vital Step Toward Ban," Arms Control Today, Washington, D.C., July 1996, 9.

<sup>22</sup> A National Security Strategy for a New Century, October 1998, 11.

<sup>23</sup> Ibid.

<sup>24</sup> Wurst, 14.

<sup>25</sup> Ibid, 16.

<sup>26</sup> Ibid.

<sup>27</sup> A National Security Strategy for a New Century, October 1998, 22.

<sup>28</sup> International Committee of the Red Cross, Anti-personnel Landmines - Friend or Foe?, Geneva, March 1996, 71.

<sup>29</sup> Wurst, 17.

<sup>30</sup> Philip Shanon, "Clinton to Act on Banning Many Types of War Mines," New York Times, 16 May 1996, sec. A, p. 12.

<sup>31</sup> Mary H. Cooper, "Banning Land Mines," CQ Researcher, 8 August 1997, 713.

<sup>32</sup> International Committee of the Red Cross, 44.

<sup>33</sup> Cooper, 713.

<sup>34</sup> Adde, 14.

<sup>35</sup> Ibid.

<sup>36</sup> Cooper, 713.

<sup>37</sup> Ibid.

<sup>38</sup> Ibid.

<sup>39</sup> Office of the Assistant Secretary of Defense, "Destruction of Last Non-Self-Destructing Anti-Personnel Landmines in U.S. Based Stockpile," 25 June 98; available from <http://www.defenselink.mil/news/jun1998/>; Internet; accessed 30 November 1998.

<sup>40</sup> Spinelli, 3.

<sup>41</sup> White House Press Release "Report to the Secretary of Defense on the Status of DoD's Implementation of the U.S. Policy on Anti-Personnel Landmines," 3.

<sup>42</sup> Julie Watson, "Flooding from Mitch Displaces Landmines," The Patriot News, 3 December 1998, sec. A, p. 16.

<sup>43</sup> Kenneth H. Bacon, DoD News Briefing, 5 May 1998; available from <http://www.defenselink.mil/news/May1998/>; Internet; accessed 30 November 1998.

<sup>44</sup> "Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction," Arms Control Today, September 1997, 13.

<sup>45</sup> Deputy Secretary of Defense John J. Hamre, "Anti-Personnel Landmine Alternative," memorandum for Secretary of the Army, Chairman, Joint Chiefs of Staff, Under Secretary of Defense (Acquisition and Technology, Policy, and Comptroller), Washington, D.C., 21 October 1997.

<sup>46</sup> Spinelli, 2.

<sup>47</sup> Kevin Weddle, LTC, "Anti-Personnel Landmine Issues Update" Briefing, Washington, D.C., 28 May 1998, slide #30.

<sup>48</sup> Hidden Killers: The Global Landmine Crisis, Washington, D.C., September 1998, Chapter 4.

<sup>49</sup> Ibid.

<sup>50</sup> MAJ Donna Miles, "Developing an Electronic Dog's Nose," American Forces Press Release, June 98; available from <http://www.dtic.mil/afps/news/>; Internet; accessed 23 January 1999.

<sup>51</sup> Carl T. Sahlin, Jr, "Global Mine Clearance: An Achievable Goal?," Strategic Forum, Number 143, August 1998, 2.

<sup>52</sup> Hidden Killers: The Global Landmine Crisis, Washington, D.C., September 1998, Chapter 4.

<sup>53</sup> Gordon R. Sullivan and Michael V. Harper, Hope is not a Method, (Broadway Books, New York, 1997), XXI.

<sup>54</sup> Wurst, 17.

<sup>55</sup> Spinelli, 3.

<sup>56</sup> Hidden Killers: The Global Landmine Crisis, Washington, D.C., September 1998, Annex C.

<sup>57</sup> Cooper, 699.

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